

Biospecimen retrieval from NASA's Rodent Research-1: maximizing science return from flight missions

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Rodent Research (RR)-1 was conducted to validate flight hardware, operations, and science capabilities that were developed to support long duration missions on the International Space Station. After 37 days in microgravity twenty mice were euthanized and frozen on orbit. Upon return to Earth the carcasses were dissected and yielded 32 different types of tissues from each mouse and over 3200 tissue aliquots. Many tissues were distributed to the Space Life and Physical Sciences (SLPS) Biospecimen Sharing Program (BSP) Principal Investigators (PIs) through the Ames Life Science Data Archive (ALSDA).

A second round of dissections was performed to collect additional tissues from the remaining carcasses thawed for a second time for additional BSP PIs. Tissues retrieved included vaginal walls, aorta, pelvis, brown adipose tissue, tail, spine and forearms. Although the analyses are still in progress, some of the PIs have reported that the quality of the tissues was acceptable for their study.

In a separate experiment we tested the RNA quality of the tissues that were dissected from frozen carcasses that were subjected to euthanasia, freezing, first and second thaw dissections. Timelines simulated the on-orbit RR-1 procedures to assess the quality of the tissues retrieved from the second thaw dissections. We analyzed the RIN values of select tissues including kidney, brain, white adipose tissue (WAT) and brown adipose tissue (BAT). Overall the RIN values from the second thaw were lower compared to those from the first by about a half unit; however, the tissues yielded RNA that are acceptable quality for some quantitative gene expression assays. Interestingly, RIN values of brain tissues were 8.4 ± 0.6 and 7.9 ± 0.7 from first and second round dissections, respectively (n=5). Kidney and WAT yielded RIN values less than 8 but they can still be used for qPCR. BAT yielded higher quality RNA (8.2 ± 0.5) than WAT (5.22 ± 0.9), possibly due to the high fat content. Together, these data show that select tissues can be utilized for gene expression studies even if they are retrieved from carcasses that were subjected to at least two freezing and thawing processes; this further expands science return from valuable and infrequent rodent experiments in space.